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### Type D Personality: A Five-Factor Model Perspective

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## TYPE D PERSONALITY: A FIVE-FACTOR MODEL PERSPECTIVE

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This study investigated the position of Type D (high Negative Affectivity and high Social Inhibition) within the Five-Factor Model (FFM) of personality. A sample of 155 healthy subjects were administered the Type D Scale and the NEO-FFI, assessing the FFM traits. Subjects also filled out the General Health Questionnaire and the Job Stress Survey. Negative Affectivity was positively correlated with Neuroticism (0.74) and negatively with Conscientiousness (−0.38), Agreeableness (−0.37), and Extraversion (−0.35). Social Inhibition was negatively correlated with Extraversion (−0.61) and Conscientiousness (−0.40) and positively with Neuroticism (0.50). Type D subjects reported more somatic distress ( $p < 0.0001$ ), anxiety ( $p < 0.0001$ ) and depression ( $p < 0.01$ ) than non-Type D subjects. An alternative one-dimensional representation of the D-traits was suggested, conceptualized as a dimension ranging from neurotic introversion with relatively low conscientiousness to stable extraversion with relatively high conscientiousness. These findings are discussed in the light of the renewed interest in psychology for type versus dimensional representations of individual differences.

**Keywords:** Type D; Five-Factor Model; Assessment; Psychological distress

Accumulating evidence suggests that inhibition of the expression of emotions may be associated with negative effects on subjective and objective health status, and well-being (Pennebaker and Traue, 1993; Temoshok, 1993; Gross and Levenson, 1997; Vingerhoets *et al.*, 1997). This evidence is accompanied by a strong interest in the conceptualization and measurement of the non-expression of emotions. Several inhibitory constructs and repressive coping styles have been suggested to explain the relationship between behavior and health outcomes (Myers, 1995, 1998), among them the “distressed” personality type or Type D (Denollet *et al.*, 1996).

Type D is based on the notion that emotional stress as a risk factor for poor health outcomes (i) reflects a relatively stable psychological characteristic and (ii) entails the presence of a wide variety of negative emotions as well as the non-expression of emotions. In other words, Type D refers to individuals who simultaneously tend to experience negative emotions and tend to inhibit self-expression in social interaction. Negative Affectivity is a broad personality trait that refers to the tendency to experience negative emotions (Watson and Clark, 1984). This tendency, for instance, has also been

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observed in a substantial proportion of cardiac patients (Denollet, 1991). Social Inhibition is another broad personality trait that refers to the tendency to inhibit the expression of emotions and behavior in social interactions (Asendorpf, 1993). Hence, Type D is defined by a high score on both negative affectivity and social inhibition. Cardiac patients with this Type D profile are not only at risk for emotional distress (Denollet, 1998) but also for adverse cardiac events (Denollet *et al.*, 1996; Denollet and Brutsaert, 1998).

The main objective of the present study was to examine how the Type D construct can be understood in terms of the Five-Factor Model of personality, a comprehensive and popular trait taxonomy describing the basic dimensions of personality. With respect to this issue, the advantages and disadvantages of a type versus a dimensional approach for the structural representation of health-related traits will be discussed. A secondary objective was to validate the Type D construct against self-reported health complaints in a non-clinical sample.

### Personality Types and Cardiovascular Health

Research on the relationship between psychosocial stress and coronary heart disease (CHD) was dominated in the seventies and eighties by work on the type-A behavior pattern. Initially, a cluster of diverse symptoms and behavioral signs were involved in the characterization of this type-A but, eventually, hostility was considered to be one of the core features (Dembroski *et al.*, 1989). Although there still is controversy surrounding the validity of the type-A construct and the mechanisms behind the relationship with CHD, one cannot deny that this line of research has influentially shaped research, theorizing, and conferencing (Matthews, 1988).

A more recent and promising line of research is the work on Type D, a personality type predicting long-term mortality in CHD patients, independently of established biomedical risk factors (Denollet *et al.*, 1995; Denollet *et al.*, 1996; Denollet and Brutsaert, 1998). Type D patients are individuals experiencing negative affect, combined with a tendency to inhibit the expression of this distress in social interactions. In a 6–10 year follow-up study, Denollet *et al.* (1996) found that CHD patients identified as Type D had a four-fold risk of death compared with non-Type D patients. Mortality was also associated with impaired left ventricular function, three-vessel disease, low exercise tolerance, and a lack of thrombolytic therapy after myocardial infarction. However, Type D remained a significant predictor of both cardiac and non-cardiac mortality, over and above the biomedical risk factors. It was especially the interaction of negative affect combined with emotional inhibition that was associated with a worse CHD prognosis. In a subsequent study, Denollet and Brutsaert (1998) demonstrated that emotional distress in these patients was unrelated to disease severity, but reflects individual differences that are stable over time and consistent across situations. Eventually, the trait-like character of the Type D pattern led to the construction of the Type D Scale-16 (DS16) (Denollet, 1998), a self-report measure to assess the Type D in clinical research and practice. The findings of a prospective 5-year follow-up study confirmed that Type D as assessed by the DS16 predicted adverse cardiac events in patients with CHD, after controlling for biomedical risk factors and depressive symptoms (Denollet *et al.*, 2000). Validation of Type D personality against models of mainstream personality is largely lacking, however.

### The Five-Factor Model

Although consensus is far from complete (Eysenck, 1991, 1992; Brand, 1994; Pervin, 1994; Block, 1995), several personality psychologists agree that five orthogonal factors can be considered as the basic dimensions underlying personality traits. These factor-analytically derived dimensions are usually labeled as Extraversion, Agreeableness, Conscientiousness, Neuroticism/Emotional Stability and finally Intellect/Culture (John, 1990). This so-called Big Five model evolved from the study of the natural language, more specifically from factoring self-ratings on personality descriptive adjectives.

Inspired by this lexical research, Costa and McCrae (1989) expanded their initial NEO-model, including scales to assess Neuroticism, Extraversion and Openness, to the Five-Factor Model (FFM), appending scales to assess the missing factors of Agreeableness and Conscientiousness. The attractive features of the FFM are that it serves as a framework to conduct systematic research and that it advances an integration of the diversity of individual differences measures (McCrae and Costa, 1996). Costa and McCrae developed the NEO-PI-R (1992), a hierarchical questionnaire to assess the five factors and their lower-level traits, that evolved to one of the standard instruments to assess the five factors in research and for applied purposes. The FFM has influentially shaped the field (De Fruyt and Mervielde, 1998), introducing a dimensional conceptualization of adaptive and maladaptive person characteristics (Widiger and Trull, 1992; Costa and Widiger, 1994), instead of the well-known discrete type and symptom cluster approach, that was and still is predominant in clinical and diagnostic thinking.

Two questions arise with respect to the study of Type D. First, how is the Type D best understood in terms of the FFM? If we can describe the Type D in five-factor terms, it might be possible to assess the Type D with omnibus personality questionnaires, enabling a re-analysis of published studies and data sets, and enhancing a meta-analysis of the association between Type D and CHD outcome. An example of a successful application of the FFM to organize the data for a meta-analysis is Barrick and Mount's work (1991; Mount and Barrick, 1998) on the relationship between personality traits and job performance. Second, what is the relative merit of a dimensional versus a type approach in the study of D-characteristics? The FFM proposes a dimensional representation of traits, suggesting that trait scores have a continuous rather than a bimodal distribution. The Type D, however, is conceptualized as a discrete type, and denotes individuals identified from a median-split on continuous Negative Affect and Social Inhibition scales. A core question is whether this trait pattern is best understood in terms of a discrete type approach – as suggested – or whether a dimensional representation is more favorable. The type-approach is in essence bimodal, distinguishing Type Ds from non-Type Ds, contrary to a dimensional representation, suggesting that subjects' trait scores vary along a continuum.

The objectives of the present study were therefore two-fold. First, the representation of the Type D in the FFM framework was investigated in a sample of healthy individuals. The second objective was more exploratory and aimed to examine an alternative conceptual representation of the D-characteristics. The validity of this alternative to predict health-related outcomes, such as perceived job stressors and self-reported general health and well-being, was also examined. It was hypothesized that the Type D individuals would differentiate from the non-Type Ds on the personality and the

self-reported general health and well being measures, but not on the job stress indices. Usually, one expects a relationship between neuroticism related traits and stress measures. However, the job stress measure used in this study was specifically constructed to limit this rating bias, mainly focusing at stressors in the workplace and instructing the respondent to compare the severity of stressors with a target item that was found in previous work to produce a moderate amount of stress (Spielberger and Vagg, 1999). These instructions result in more balanced ratings around the target-item per individual, limiting the expected rating bias. The convergent validity of an alternative conceptualization of the D-traits is thus demonstrated when it shows a similar correlation pattern as the Type D constituting scales with the FFM personality measures and the general health and well-being indices, whereas discriminant validity is demonstrated when it is not substantially related to job stress measures.

## METHOD

### Participants

A sample of 95 policemen and 60 nurses, all employees of a large Flemish city, participated in this study to identify job stressors. The sample included 85 women and 66 men; 4 subjects did not specify gender. They were on average 32 years, with a minimum of 20 years and a maximum of 56 years. Participation was voluntary and anonymous. Participating departments were selected by the employer, by mutual arrangement with the trade unions. Questionnaires were distributed at the workplace. Individuals were requested to fill in the questionnaires at home and return the inventories to the research agency that was organizing the job stress survey. Nearly 30% of the eligible subjects returned questionnaires. No data were eligible on the non-respondents.

### Questionnaires

*DS16/DS24* Empirical and structural criteria were used in previous research to devise the DS16, comprising an 8-item Negative Affectivity and an 8-item Social Inhibition scale (Denollet, 1998). These scales were found to be reliable ( $\alpha = 0.89$  and  $0.82$ ; test-retest =  $0.78$  and  $0.87$ ), and Type D as measured by the DS16 was associated with depressive symptoms (Denollet, 1998) and increased risk for cardiac events (Denollet *et al.*, 2000) in CHD patients. In the present study, we used an extended version of this scale (DS24), including 3 facet scales (4 items each) for the Negative Affectivity (NA) and Social Inhibition (SI) domains. The Negative Affectivity domain includes facets to assess Insecurity related to the Self, Dysphoria and Tension. Social Inhibition can be decomposed in Insecurity related to Others, Reticence and Withdrawal. Type D individuals are identified from a median-split on the Negative Affect and Social Inhibition scales, combining high Negative Affect with high Social Inhibition.

*NEO-FFI* (Costa and McCrae, 1992; Hoekstra *et al.*, 1996). The NEO-FFI is the short form of the NEO-PI-R, including 60 items, with 12 item-scales to assess the domains of Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A) and

Conscientiousness (C). The psychometric characteristics of this adaptation are satisfactory (Hoekstra *et al.*, 1996; De Fruyt and Mervielde, 1998).

*Job Stress Survey* (JSS; Spielberger and Vagg, 1999). The JSS was developed to enable a quick assessment of job stress and comprises 30 items that were identified in a range of occupations as main determinants of job stress. The JSS includes two subscales, i.e. job pressure and lack of organizational support, and assesses both the severity and frequency of occurrence of these stressors. An overall Job Stress Index can be calculated, as well as an interaction of severity and frequency measures. The JSS factor structure has proven to be easily replicable in different Western-European translations and has comparable good psychometric characteristics as reported for the US version (Spielberger and Vagg, 1999; Haseth, in press).

*General Health Questionnaire* (GHQ28; Goldberg, 1978; Koeter and Ormel, 1991). The 28-item form of the General Health Questionnaire (GHQ28) was used as a criterion measure, including factor scales to assess Somatic complaints, Anxiety and Sleeping problems, Inefficient work and Depression. The GHQ28 is widely used in research as a marker of self-reported health status and well-being. The reliabilities of the factorscales are usually greater than 0.80 (Koeter and Ormel, 1991).

### Analyses

Pearson correlations were calculated to investigate Type D–FFM relationships and the relationships with criterion measures. Regression analysis was used to examine the amount of shared variance between the NA and SI scales and the FFM dimensions. An alternative conceptualization of the Type D characteristics, entitled the D-factor, was constructed by extraction of the first unrotated component of a principal component analysis. Finally, hierarchical regression analysis was used to evaluate whether a comprehensive trait model such as the FFM predicts D-factor variance over and above the D-type facet scales. If the FFM dimensions would significantly and substantially add to the prediction of the D-factor scores, then one might assume that the content of the D-factor is different from the content covered by the broadest operationalisation of the Type D, i.e., scales at the facet level. Such a finding would question both the validity and equivalence of the alternative conceptualization. The six facet scales of the DS24 were entered in a first step, followed by the NEO-dimensions in a second step.

## RESULTS

### Type D–FFM Relationships

The correlations between the dimensions of the FFM and the scales used to identify individuals as Type D are described in Table I. The FFM correlations with both the short and the extended scales to assess Negative Affectivity and Social Inhibition are reported. NA is strongly correlated with Neuroticism ( $r=0.68$  and  $0.74$ ; both  $p<0.001$ ) and correlates negatively, but to a lesser extent, with Extraversion ( $r=-0.42$  and  $-0.35$ ; both  $p<0.001$ ), Agreeableness ( $r=-0.42$  and  $-0.37$ ; both  $p<0.001$ ) and Conscientiousness ( $r=-0.43$  and  $-0.38$ ; both  $p<0.001$ ). SI is negatively

TABLE I Correlations between Type D scales and FFM dimensions

	<i>DS16 Negative Affectivity</i>	<i>DS16 Social Inhibition</i>	<i>DS24 Negative Affectivity</i>	<i>DS24 Social Inhibition</i>
Neuroticism	0.68***	0.49***	0.74***	0.50***
Extraversion	-0.42***	-0.52***	-0.35***	-0.61***
Openness	-0.04	-0.23*	-0.02	-0.12
Agreeableness	-0.42***	-0.14	-0.37***	-0.24**
Conscientiousness	-0.43***	-0.38***	-0.38***	-0.40***

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

TABLE II Regression parameters of NEO-FFI scales predicting Type D subscales

	<i>Type D scales</i>			
	<i>DS16</i>		<i>DS24</i>	
	<i>Negative Affectivity</i>	<i>Social Inhibition</i>	<i>Negative Affectivity</i>	<i>Social Inhibition</i>
	<i>Std <math>\beta</math></i>	<i>Std <math>\beta</math></i>	<i>Std <math>\beta</math></i>	<i>Std <math>\beta</math></i>
Neuroticism	0.55***	0.30***	0.69***	0.28***
Extraversion	-0.12	-0.40***	-0.03	-0.49***
Openness	0.04	-0.24***	0.09	-0.12
Agreeableness	-0.16*	0.20*	-0.11	0.08
Conscientiousness	-0.08	-0.17	-0.03	-0.10
$R^2$	0.53***	0.45***	0.57***	0.48***

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

related to Extraversion ( $r = -0.52$  and  $-0.61$ ; both  $p < 0.001$ ) and to a lesser extent to Conscientiousness ( $r = -0.38$  and  $-0.40$ , both  $p < 0.001$ ). Furthermore, SI correlates about  $r = 0.50$  ( $p < 0.001$ ) with Neuroticism.

The regression analyses reported in Table II demonstrate that about half of the variances of the NA [ $F(5,114) = 25.34$ ,  $p < 0.001$  for the DS16;  $F(5,114) = 30.67$ ,  $p < 0.001$  for the DS24] and SI, [ $F(5,114) = 18.40$ ,  $p < 0.001$  for the DS16;  $F(5,114) = 20.70$ ,  $p < 0.001$  for the DS24] scales are predicted by the FFM dimensions. NA is mainly predicted by Neuroticism (std  $\beta = 0.55$ ,  $p < 0.001$  for the DS16; std  $\beta = 0.69$ ,  $p < 0.001$  for the DS24), whereas SI is negatively predicted by Extraversion (std  $\beta = -0.40$ ,  $p < 0.001$  for the DS16; std  $\beta = -0.49$ ,  $p < 0.001$  for the DS24) and positively by Neuroticism (std  $\beta = 0.30$ ,  $p < 0.001$  for the DS16; std  $\beta = 0.28$ ,  $p < 0.001$  for the DS24). There are marked differences between the DS16 and DS24 scales. The NA scale of the DS16 is additionally negatively predicted by Agreeableness (std  $\beta = -0.16$ ,  $p < 0.05$ ), whereas Agreeableness predicts the SI scale positively (std  $\beta = 0.20$ ,  $p < 0.05$ ) and Openness contributes negatively to the SI scores (std  $\beta = -0.24$ ,  $p < 0.001$ ). The DS16 scales are thus more heterogeneous in terms of their representation within the FFM compared to their DS24 counterparts.

### Alternative Conceptualizations

The substantial correlations among the DS24 NA and SI scales ( $r = 0.59$ ,  $p < 0.0001$ ) and their similar correlation pattern with the FFM warranted examination of an



TABLE III Correlates of the D-factor

<i>External correlate</i>	<i>D-factor (p)</i>
DS24 negative affectivity	0.88***
DS24 social inhibition	0.88***
Neuroticism	0.71***
Extraversion	-0.57***
Openness	-0.07
Agreeableness	-0.32***
Conscientiousness	-0.50***
JSS severity pressure	0.16
JSS severity lack of support	-0.05
JSS frequency pressure	0.17
JSS frequency lack of support	0.22*
JSS index	0.25*
GHQ28-somatisation	0.29**
GHQ28-anxiety-sleeping problems	0.34***
GHQ28-inefficient work	0.09
GHQ28-depression	0.28**
GHQ28-total score	0.38***

JSS: Job Stress Survey (Spielberger and Vagg, 1999); NEO: NEO-FFI (Costa and McCrae, 1992), GHQ28: General Health Questionnaire 28 (Goldberg, 1978), \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

alternative structural representation of the variance enclosed in the DS24 items. Factoring the DS24 at the item-level shows a first component that explains 30% of the variance. The second and third components account for smaller proportions of the variance, i.e. 8.99 and 5.64%, respectively. Inspection of the scree plot shows a considerable drop after the first component. Therefore, we extracted the first unrotated component and calculated factor scores for this dimension. The first unrotated component is assumed to provide the best estimate of the variance shared by a group of related measures (Jensen, 1998). This operation has important conceptual consequences, because it involves a shift from a type towards a one-dimensional representation of the D-characteristics.

The correlations of the NA and SI scales with this unrotated factor, further on entitled the D-factor, are reported in Table III. The high correlations (both  $r = 0.88$ ,  $p < 0.001$ ) suggest that the unrotated component clearly represents the constituting elements of the Type D. The D-factor strongly correlates with Neuroticism ( $r = 0.71$ ,  $p < 0.001$ ), and correlates substantially negatively with Extraversion ( $r = -0.57$ ,  $p < 0.001$ ), Conscientiousness ( $r = -0.50$ ,  $p < 0.001$ ) and to a lesser extent with Agreeableness ( $r = -0.32$ ,  $p < 0.001$ ). Openness is not empirically linked to the D-traits.

### Validity of Type D in a Non-Clinical Sample

Using median splits on the DS24 Negative Affectivity and Social Inhibition scales, 48 subjects were classified as Type D (i.e. above median on both scales) and 87 as non-Type D. Mean scores for perceived job stress and general health and well-being for Type D and non-type subjects are reported in Table IV. Subjects identified as Type D do not differ significantly from the non-Type Ds with respect to experiencing job stress. The Type Ds, however, report significantly more somatic complaints [ $F(1,126) = 18.50$ ,  $p < 0.001$ ], anxiety and sleeping problems [ $F(1,125) = 20.75$ ,

TABLE IV Validity criteria : JSS, GHQ28 and NEO-FFI scores for Type D and non-Type D subjects

	Type D (N = 48)	Non-Type D (N = 87)	FP
JSS severity pressure	50.46	46.56	2.90
JSS severity lack of support	51.00	52.72	0.48
JSS frequency pressure	36.91	31.72	1.55
JSS frequency lack of support	26.20	21.11	1.97
JSS index	16.69	12.75	3.15
GHQ28-somatisation	13.72	10.80	18.50***
GHQ28-anxiety/sleeping problems	14.11	11.14	20.75***
GHQ28-inefficient work	13.22	13.04	0.20
GHQ28-depression	9.07	7.70	10.10**
GHQ28-total score	50.39	42.51	21.78***
NEO-neuroticism	32.83	26.00	43.47***
NEO-extraversion	40.84	46.21	37.61***
NEO-openness	36.20	37.55	1.71
NEO-agreeableness	43.02	45.51	7.71**
NEO-conscientiousness	42.83	48.04	29.86***

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ .

$p < 0.001$ ] and they obtain higher scores on the GHQ28 Depression scale [ $F(1,126) = 10.10$ ,  $p < 0.01$ ]. They further obtain higher scores for Neuroticism [ $F(1,124) = 43.47$ ,  $p < 0.001$ ], and lower scores for Extraversion [ $F(1,120) = 37.61$ ,  $p < 0.001$ ], Conscientiousness [ $F(1,122) = 29.86$ ,  $p < 0.001$ ] and Agreeableness [ $F(1,119) = 7.71$ ,  $p < 0.01$ ].

Validities for the D-dimensional representation are reported in Table III. There are only small to moderate non-significant correlations with JSS measures, except for a significant but small correlation with the JSS Frequency measure for Lack of Organizational support ( $r = 0.22$ ,  $p < 0.05$ ). This relationship is further reflected in the general JSI index ( $r = 0.25$ ,  $p < 0.05$ ), an aggregate measure combining both severity and frequency of the 30 job stressors identified in the JSS. However, the D-factor shows substantial positive correlations with GHQ28 scales assessing health and well-being,  $r$  ranging from 0.28 to 0.38 (all  $p < 0.01$ ). The correlation pattern for the D-factor parallels the observed differences for the Type D construct.

The results of the stepwise hierarchical linear regression analysis are reported in Table V. The results show that 74% ( $p < 0.001$ ) of the D-factor variance is explained by the D-type facet scales. Especially, the NA facet scale Insecurity/Self (std  $\beta = 0.40$ ,  $p < 0.001$ ) and the SI-Reticence (std  $\beta = 0.31$ ,  $p < 0.001$ ) and Withdrawal (std  $\beta = 0.30$ ,  $p < 0.001$ ) scales significantly predict D-factor scores. The other DS24 facet scales do not significantly contribute to the prediction. The NEO-FFI scales add about 4% ( $R^2$  change:  $p < 0.001$ ) to the prediction over and above the DS24 facet scales. This addition, although significant, is not very substantial. More specifically, the Conscientiousness (std  $\beta = -0.17$ ,  $p < 0.01$ ) and, to a lesser extent, Neuroticism (std  $\beta = 0.15$ ,  $p < 0.05$ ) domains significantly add to the prediction.

## DISCUSSION

The core features of the Type D, i.e. NA and SI, could be easily represented in a comprehensive trait taxonomy such as the FFM. NA was primarily related to Neuroticism,

TABLE V Stepwise hierarchical regression results with D-facet scales (Step 1) and NEO-FFI dimensions (Step 2) predicting D-factor scores

	<i>D-factor, Std <math>\beta</math></i>	
	<i>Step 1</i>	<i>Step 2</i>
Step 1		
NA-insecurity/self	0.40***	0.29***
NA-dysphoria	-0.09	-0.05
NA-tension	0.04	0.02
SI-insecurity/others	-0.07	-0.07
SI-reticence	0.31***	0.32***
SI-withdrawal	0.30***	0.29***
Step 2		
NEO-N		0.15*
NEO-E		0.08
NEO-O		0.02
NEO-A		0.00
NEO-C		-0.17**
$R^2$	0.74***	0.78***
$R^2$ change		0.04***

NA: Negative Affectivity; SI: Social Inhibition; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

with substantial negative correlations with Conscientiousness, Extraversion and Agreeableness. The magnitude of the correlations was slightly dependent whether the short or the extended Type D domain scales were used to assign Type D membership. The correlation pattern for the SI characteristic was very similar for Openness, Agreeableness, and Conscientiousness, but the scale correlated most strongly with Extraversion (negatively) but also with Neuroticism. Neuroticism and Extraversion (reversed) seemed to be the core features of the Type D, suggesting that Type D could best be described in the circumplex formed by the Neuroticism and the Extraversion dimensions, with the D-persons assigned to the N + E-segment. These two main trait dimensions explained about half of the variance of the D-construct. On the one hand, they are dimensions assessed by most personality inventories, enhancing a meta-analysis to replicate the Type D – cardiovascular health status associations. On the other hand, the present data also suggested that the Type D scales were not identical to standard N and E measures. Social Inhibition, for example, refers to pervasive individual differences in non-expression, withdrawal, and insecurity when with others. This global trait is closely related to the interpersonal but not to the intrapsychic dimension (i.e. positive affect, energy, excitement seeking) of extraversion (Denollet, 1998).

The FFM–Type D relationships do not discredit the type approach that is predominant in the study of health and disease. Diagnostic classification has always been prominent in medical and clinical thinking, whereas a variable-oriented approach is more suited for research and has evolved to the main research tool in differential psychology today (Bergman and Magnusson, 1998). The usefulness of combining the dimensional and the type approach has been recently discussed by Mervielde and Asendorpf (2000). In a discussion of variable-centered and person-centered approaches to personality, they suggest to classify individuals in discrete types according to their scores on basic personality dimensions. Similar proposals have been formulated by

Costa and McCrae (1998) for the industrial and organizational psychology area, defining six discrete personality styles based on pairings of two dimensions of the FFM. The results of the present study demonstrate that a general comprehensive trait model is useful to study health related traits and types such as Type D.

Given the substantial shared variance by the scales defining Type D, a dimensional representation of the D-characteristics was suggested, formed by the first unrotated factor resulting from factoring the DS24 at the item level. The first unrotated component is thought to provide the best estimate of the variance shared by a group of correlated items. This operation includes a conceptual shift, from a type to a one-dimensional trait construct. In terms of the FFM, the resulting D-factor represents trait variance ranging from Neurotic Introversion to Stable Extraversion. Furthermore, the factor is strongly negatively correlated with Conscientiousness. The position of this D-factor within the FFM corresponds to Cloninger's Harm Avoidance temperament dimension (Zuckerman and Cloninger, 1996; De Fruyt *et al.*, 2000) and Gray's anxiety factor (Gray, 1982). Both Cloninger (Cloninger *et al.*, 1994) and Gray link their dimensions to monoamine neurotransmitter systems as a basis for explaining trait differences. The observed similarities between the D-factor and Cloninger's and Gray's dimensions open new perspectives to study the biological basis of the D-traits.

The Type D typology differentiated among criteria where it was supposed to denote differences, underscoring its validity. With respect to the NEO-scales, large differences were observed for N, E, C and a smaller difference for A. The relationship between Type D and low scores on conscientiousness is of special interest, given the fact that low conscientiousness scores have been shown to predict mortality over the life span (Friedman *et al.*, 1993). Furthermore, Type D individuals obtained higher scores on all affect-related GHQ28-scales, but not on the job stress measures. The D-factor correlates resembled the pattern observed for the Type D, with an exception for one JSS subscale. Participants demonstrated considerable variation on the job stress indices, comparable to population-based research, limiting the possibility that range restriction was responsible for the weak correlations.

In order to evaluate whether the alternative conceptualization did not capture variance beyond the DS24 facet scales, the predictive validity of the FFM-scales over and beyond the DS24 subscales was examined. Hierarchical multiple regression analysis indicated that D-factor scores could be predicted to a large extent (74%) by three of the DS24 facet scales, i.e. NA-Insecurity/Self, SI-Reticence and SI-Withdrawal. The remaining facet scales did not significantly add to the prediction. The NEO-FFI-scales significantly added variance in this dimensional model, but the amount of additional explained variance was limited to 4%. Two of the Big Five, i.e. Neuroticism and Conscientiousness added to the prediction over and above the DS24 facet scales. Standing on the D-factor is thus best understood in terms of the DS24 inventory, with slight contributions from Conscientiousness and Neuroticism. These results suggest that the D-factor mainly assessed the D-traits, underscoring its content validity.

The present findings do not provide evidence for replacing the Type D construct by the D-factor. We feel that the two conceptualizations deserve more attention and have both their strengths and weaknesses. The D-factor conceptualization probably better highlights the position of the D-traits in other personality descriptive and temperament systems, such as Cloninger's temperament and character model or Gray's biopsychological personality model. The careful positioning in more biological oriented personality descriptive systems may enhance our understanding of the mechanisms behind the

D-traits. The diagnostic classification based on a median-split procedure using the NA and SI scales has been shown to reliably predict major health outcomes in patients with CHD (e.g. Denollet *et al.*, 2000). This classification, however, may be dependent from sample characteristics and the distribution of NA and SI scores. Positively or negatively skewed distributions for the NA and SI scales imply a relative danger of misclassification of Type D subjects, especially when no population-based classification cut-offs are available.

The position of the Type D within the FFM framework should be further examined using the more comprehensive NEO-PI-R (Costa and McCrae, 1992), assessing higher and lower level traits. The present study is preliminary with respect to the proposed alternative representation of Type D. First, Type D was delineated primarily from research on patients suffering from CHD. The alternative representation in the present study was based on research with healthy subjects. In addition, only about 30% of the potential participants filled out the questionnaires, further limiting the generalizability of the present results. Furthermore, the present validity research involved the prediction of subjective rather than objective health parameters, such as CHD or mortality. Therefore, the present analyses should be replicated in independent research, involving CHD patients and predicting the objective criteria for which the Type D and its measures were initially designed. Finally, the present findings corroborate the validity of the Type D construct as a predictor of emotional distress in non-clinical samples.

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